

REMARKS

The present Amendment amends claims 1 and 3-5 and cancels claims 2 and 6. Therefore, the present application has pending claims 1 and 3-5.

In paragraph 1 of the Office Action the Examiner objected to the Information Disclosure Statement submitted on December 24, 2003 as allegedly failing to comply with 37 CFR §1.98(a)(1). Filed on even date herewith is a Form PTO-1449 listing the reference submitted by the December 24, 2003 Information Disclosure Statement. An indication that the cited references have been considered is respectfully requested.

Claim 1 stands objected to due to informalities noted by the Examiner in paragraph 2 of the Office Action. Amendments were made to claim 1 to correct the informalities noted by the Examiner. Therefore, this objection is overcome and should be withdrawn.

Claim 4 stands rejected under 35 USC §112, second paragraph being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regards as their invention. Various amendments were made throughout claim 4 to bring them into conformity with the requirements of 35 USC §112, second paragraph. Therefore, this rejection with respect to claim 4 is overcome and should be withdrawn.

Specifically, amendments were made throughout claim 4 to overcome the objections noted by the Examiner in the Office Action.

Claims 1 and 5 stand rejected under 35 USC §103(a) as being unpatentable over Zak (U.S. Patent No. 6,084,926); claims 2 and 6 stand rejected under 35 USC §103(a) as being unpatentable over Zak and further in view of Akahori (U.S. Patent Application Publication No. 2002/0034266 A1);

claim 3 stands rejected under 35 USC §103(a) as being unpatentable over Zak, Akahori in view of Lim (U.S. Patent No. 5,588,027) and further in view of Sano (U.S. Patent No. 6,836,518); and claim 4 stands rejected under 35 USC §103(a) as being unpatentable over Zak, Akahori, Sano and further in view of Betts (U.S. Patent No. 4,796,279). As indicated above, claims 2 and 6 were canceled. Therefore, the 35 USC §103(a) rejection of claims 2 and 6 as being unpatentable over Zak in view of Akahori is rendered moot. Accordingly, reconsideration and withdrawal of the 35 USC §103(a) rejection of claims 2 and 6 is respectfully requested.

It should be noted that the cancellation of claims 2 and 6 was not intended nor should it be considered as an agreement on Applicants part that the features recited in claims 2 and 6 are taught or suggested by any of the references of record whether taken individually or in combination with each other. The cancellation of claims 2 and 6 was simply intended to expedite prosecution of the present application. Applicants hereby reserve their right to pursue the invention as set forth in a continuing application.

The above noted 35 USC §103(a) rejections with respect to the remaining claims 1 and 3-5 is traversed for the following reasons. Applicants submit that the features of the present invention as now recited in claims 1 and 3-5 are not taught or suggested by Zak, Akahori, Lim, Sano and Betts whether taken individually or in combination with each other as suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw these rejections.

Amendments were made to claims 1 and 3-5 in order to more clearly describe features of the present invention and to bring the claims into

conformity with U.S. practice. Particularly, amendments were made to claims 1 and 3-5 to recite that the present invention is directed to a demodulator and a demodulation method of a differential detection system for a $\pi/4$ shifted Quadrature Phase Shift Keying (QPSK) or Differential Quadrature Phase Shift Keying (DQPSK) modulation wave in digital communication.

The demodulator according to the present invention includes a plurality of differential detectors each connected to receive an orthogonal component of the modulation wave, a corrector connected to receive outputs of the differential detectors for correcting a deviated distribution of signal points on a constellation, and a slicer/decoder connected to receive outputs of the corrector.

Further, according to the present invention the slicer/decoder decodes a received bit from the signal points of the deviated distribution thereof is corrected.

Still further, according to the present invention the corrector has a plurality of average calculators each connected to receive an output of a respective one of the differential detectors and a plurality of subtractors each connected to receive an output of a respective one of the differential detectors and also receive an associated one of outputs of the average calculators for subtracting an average value of the output of the differential detector from an output of the differential detector.

The above described features of the present invention now more clearly recited in the claims are not taught or suggested by any of the references of record whether said references are taken individually or combination with each other. Particularly, the above described features of the

present invention as now more clearly recited in the claims are not taught or suggested by Zak, Akahori, Lim, Sano and Betts whether said references are taken individually or in combination with each other as suggested by the Examiner.

In the Office Action, the Examiner contends that Zak discloses a corrector (decoder) for correcting a deviated distribution of signal points on a constellation, that the deviated distribution is interpreted to be an error and that the decoder has error correction capability corresponding to the present invention. While it may be true that the decoder of Zak has an error correction function of a certain kind, and has a certain amount of error correction capability, however, it is clear that if multi-path exists, it becomes impossible for the decoder of Zak to handle as in the present invention. Thus, in Zak error correction in multi-path situations the transmission quality is disregarded. Zak confirms such by stating that, for example, MLSE is used as a second path in order to remove the influence or effect of multi-path.

The object of the present invention is to improve the decoder output quality while suppressing the influence or effect of multi-path to a maximum possible extent with a simple structure, and without using equalizers such as MLSE or the like as taught by Zak. Thus, element 10 of Fig. 1 according to the present invention is different from the decoder of Zak in construction and effect. Therefore, the Examiner's contention that the decoder of Zak corresponds to the decoder of the present invention is completely in error.

In the Office Action, the Examiner further mentions OFDM as an example of techniques for avoiding the effect of multi-path. It may be true that OFDM is a superior communication scheme defined on a communication

system that has a good multi-path immunity, but both transmission side and reception side are required to support the OFDM scheme. The present invention is directed to single-carrier transmissions, not OFDM and particularly the present invention intends to suppress the influence or effect of multi-path on the reception side. Accordingly, the use by the Examiner of any OFDM to reject the claims of the present application is inappropriate.

Thus, Zak fails to teach or suggest that the corrector has a plurality of average calculators each connected to receive an output of a respective one of the differential detectors and a plurality of subtractors each connected to receive an output of a respective one of the differential detectors and also receive an associative one of outputs of the average calculators for subtracting an average value of an output value of the differential detector from the output of the differential detector as recited in the claims.

Therefore, Zak fails to teach or suggest the features of the present invention as now more clearly recited in the claims and as such does not anticipate nor render obvious the claimed invention. Accordingly, reconsideration and withdrawal of the 35 USC §103(a) rejection of claims 1 and 5 as being unpatentable over Zak is respectfully requested.

The above described deficiencies of Zak are not supplied by any of the other references of record whether said references are taken individually or in combination with each other. Therefore, combining Zak with any of the other references of record namely Akahori, Lim, Sano or Betts, still fails to teach or suggest the features of the present invention as now more clearly recited in the claims.

In the Office Action, the Examiner contends that Akahori teaches calculating an average value of the phase differences and subtracting the average value from the original signal phase to remove a carrier frequency phase error and that by combining this teaching of Akahori with Zak, the present invention is obvious. Applicants disagree.

While, in Akahori, the calculation involved is made to the phase of the delay detection output signal, the calculation defined in the claims is made to each of real component (in-phase component) and imaginary component (orthogonal component). Thus, the present invention is structurally different from Akahori. In Akahori, an effect is the frequency difference removal, while in the present invention the difference from Akahori, the effect is the removal of the influence of the delay spread. Thus, the Examiner's allegations are completely in error.

In addition to the above, at no point is there any teaching or suggestion in Akahori of a corrector 10 as illustrated in Fig. 1 of the present application which includes a plurality of average calculators and a plurality of subtractors as now recited in the claims. Akahori simply teaches, for example, in the Abstract thereof a detector which involves one-symbol-delayed phase information and two-symbol-delayed phase information. This teaching of Akahori is completely irrelevant to the features of the present invention as now more clearly recited in the claims.

The above described deficiencies of both Zak and Akahori are not supplied by any of the other references of record namely Lim, Sano and Betts. Lim is merely relied upon by the Examiner for an alleged teaching for an intermediate buffer memory which stores data from a first and second A/D

converter, Sano is merely relied upon by the Examiner for an alleged of first and second multipliers, and Betts is merely relied upon by the Examiner for an alleged teaching of a register for storing the sum of the two multipliers. However, even if Lim, Sano and Betts supplied the above alleged teachings, combining them with Zak and Akahori in the manner suggested by the Examiner in the Office Action would still result in a combination that does not teach or suggest the above described features of the present invention now more clearly recited in the claims.

Thus, combining Zak and Akahori with one or more of Lim, Sano and Betts fails to teach or suggest the features of the present invention as now more clearly recited in the claims and as such does not render obvious the claimed invention. Accordingly, reconsideration and withdrawal of the 35 USC §103(a) rejections of claims 3-5 as being unpatentable over Zak and Akahori combined with one or more of Lim, Sano or Betts is respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references utilized in the rejection of claims 1-6.

In view of the foregoing amendments and remarks, Applicants submit that claims 1 and 3-5 are in condition for allowance. Accordingly, early allowance of the present application based on claims 1 and 3-5 is respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C., Deposit Account No. 50-1417 (500.43356X00).

Respectfully submitted,

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